Water Harvesting Traditions in the Desert Southwest

Water harvesting and conserving techniques were used by native Americans for centuries to produce abundant harvests in the deserts of the southwestern United States and northern Mexico. These systems hold vital lessons for modern inhabitants here and in arid and semiarid areas around the world.

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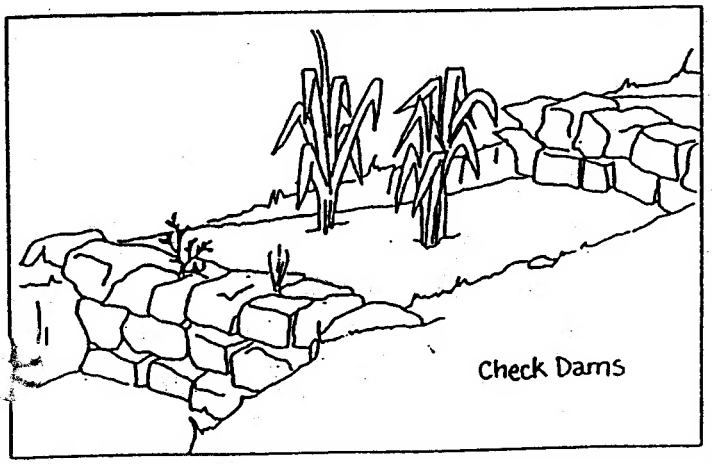
Illustrations by Roxanne Swentzell

Before the advent of modern irrigation technology, peoples of the American southwest relied upon an array of water harvesting and conserving techniques to grow their food. Not only are these techniques still appropriate, but their use, scale, and at times failures have much to teach us. Several of the systems used by the traditional people are described and illustrated below.

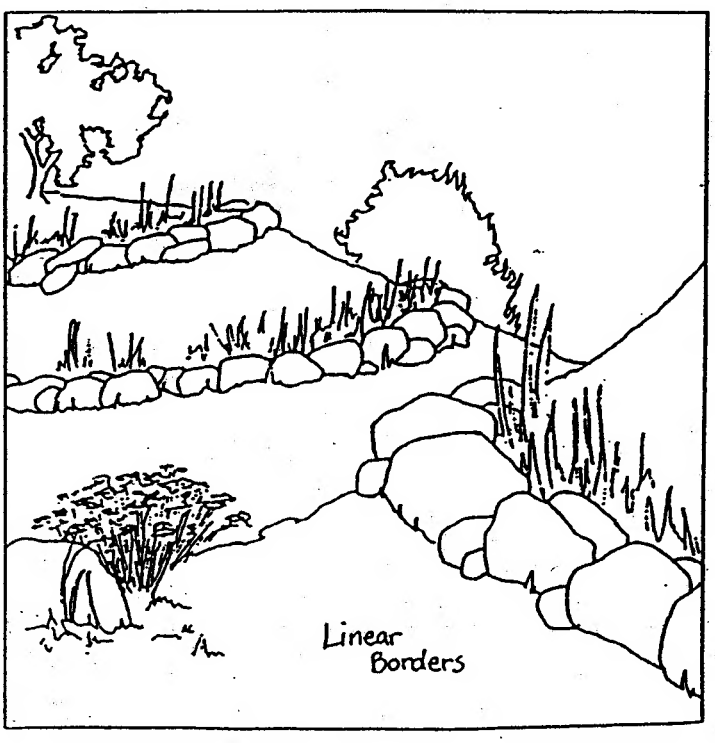
Check Dams

Check dams are built across drainages that flow only periodically. They are constructed of rock and can range in size from small to large. These rock dams catch soil and water, and were often built higher as more soil accumulated behind them. They provided an excellent way to fertilize soil and stabilize drainages, and were used for all kinds of crops. There are good examples in Colorado, Utah, and New Mexico at Mesa Verde and Hovenweep National Parks and numerous small dams in the upper Rio Grande and Chama drainages and throughout the Pajarito Plateau.



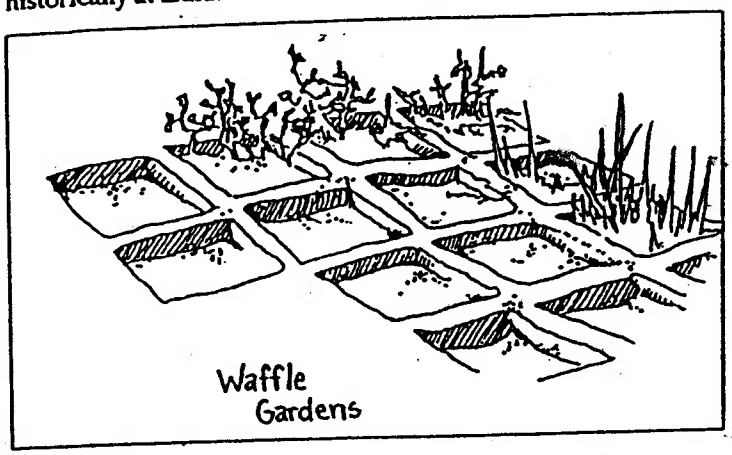
Terraces or Linear Borders

Terraces themselves were sometimes built, but check dams and low lines of stone across slopes of hills were more common. At Point of the Pines in Arizona, hilltop pueblos were surrounded by concentric rings of rocks gathered from the entire hillside and laid along contour lines across the slopes. Soil washing down the bare hillsides caught behind the stone walls, accumulating up to 16 inches deep. This loose soil would have been highly fertile and water absorbing.



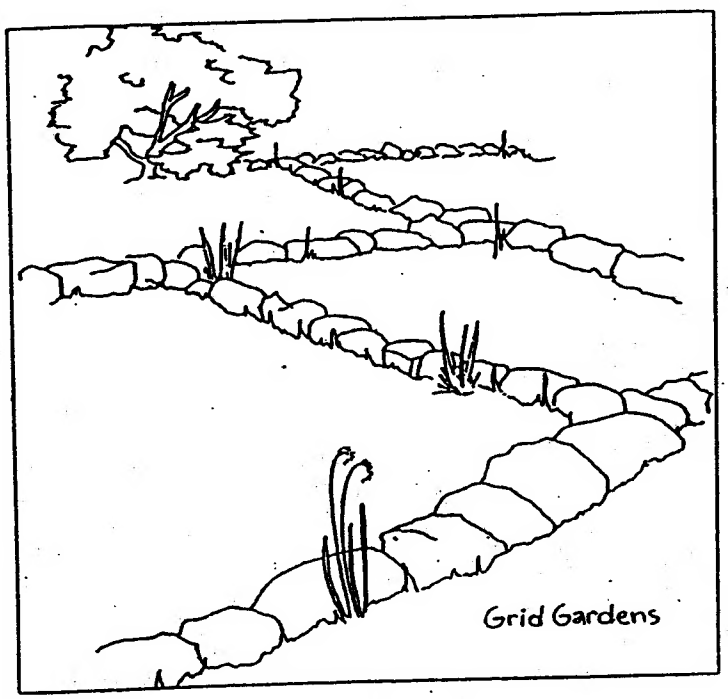
Waffle Gardens

Waffle gardens can be either sunken beds with ground-level berms, or ground-level beds surrounded by raised berms of earth. The bermed beds catch and hold rainwater as well as retain water brought by hand. Waffle beds were built on a very small scale for especially valuable crops. They are best known historically at Zuñi.



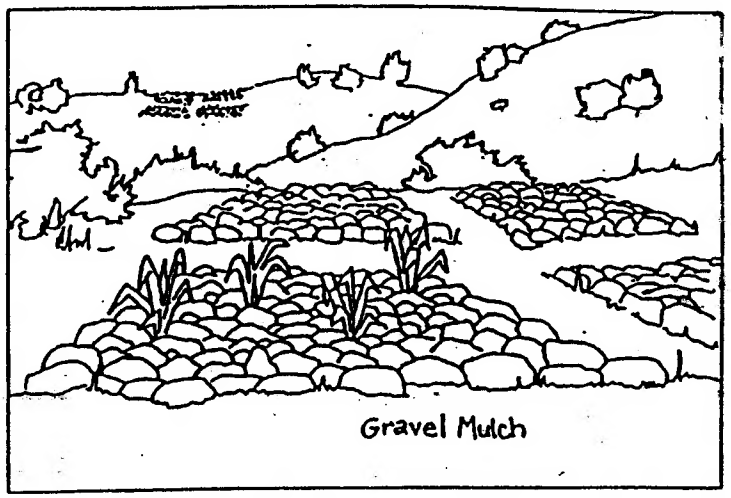
Grid Gardens

Grid gardens are similar to waffle gardens, but have walls made of stone rather than earth. They usually have much larger beds than waffle gardens. The walled beds help hold soil and were often placed to catch water runoff from moderate slopes. They were used extensively during prehistoric times throughout the upper Rio Grande, the Chama, and the Ojo Caliente drainages. They were probably not hand watered and it appears likely they were used to grow major crops such as corn and beans.



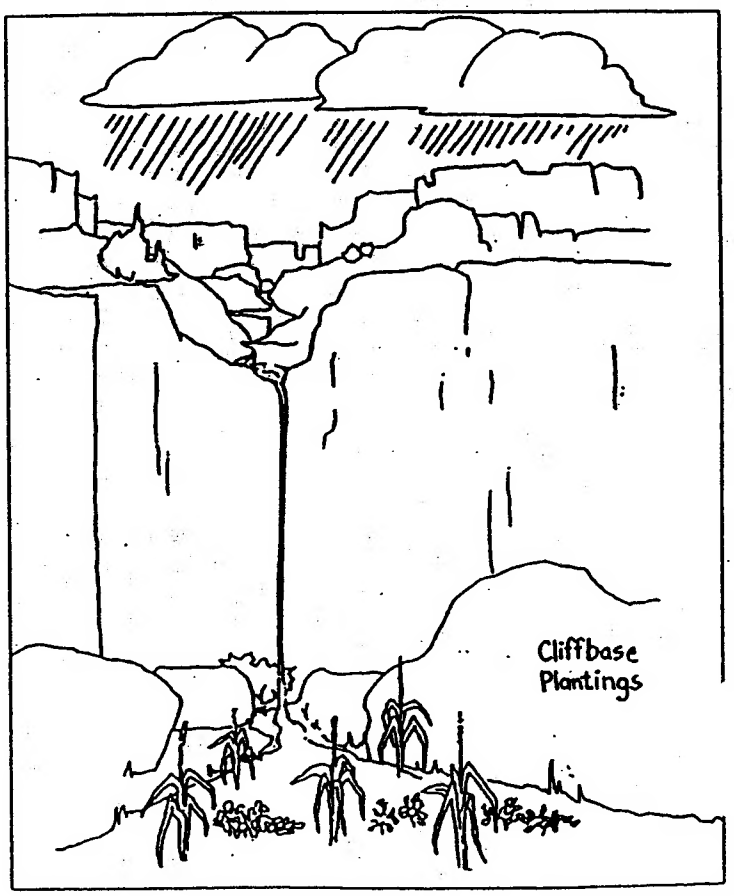
Gravel- and Rock-Mulched Fields

Mulch of any kind slows evaporation by sheltering the soil surface. The Anasazi clearly knew this. Throughout the upper Rio Grande and Chama Drainages, vast areas were mulched with gravel. Grid gardens were often covered with mulch. Gravel mulches not only conserve moisture, they also reduce wind and water erosion. Dark gravel mulches increase soil and air temperatures, reducing the threat of early and late frosts. At Wapatki in northern Arizona, the Sinagua people were able to grow food without supplemental water largely because of the natural covering of cinders created by the eruption of Sunset Crater. This eruption, and the resultant layer of cinders which covered highly fertile, water-holding volcanic ash, was responsible for Anasazi, Hohokam, and Mogollon people moving into this area to live, creating the Sinagua culture around A.D. 1000.



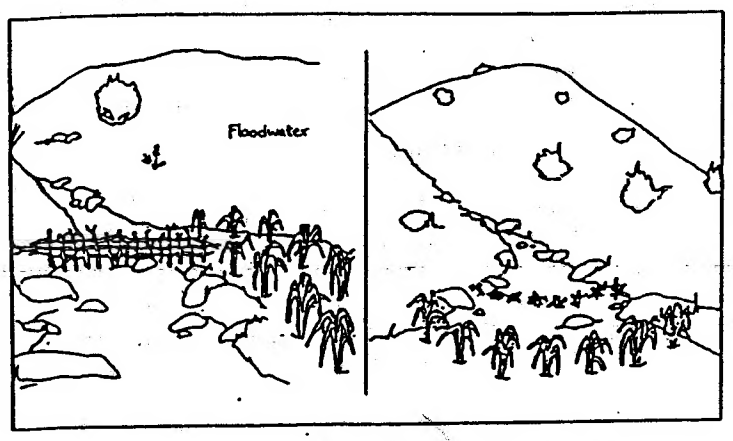
Cliffbase Plantings

Often the water-collecting surfaces of cliffs were used to provide water for crops. By planting where water would run off and be concentrated, available moisture and fertility could be increased. At Chaco Canyon this technique was used extensively. A complex irrigation system was developed using cliff runoff. Grid gardens, checkdams, and terraces were located in various places to catch this runoff.



Floodwater Farming

Often the fans of soil below arroyos or small canyons were planted to utilize the flood waters coming down these drainages. This is sometimes known as *akchin* farming and is still practiced by the O'odham and Hopi. In some cases, the field is sited beside the path of the arroyo. Brush weirs are then constructed across the bed of the arroyo to direct water out of the arroyo and onto the field. A destructive flood will blow out the weir, but will not destroy the field. Destruction of the field by a flood is a very real problem with *akchin* farming for fields located directly in the paths of arroyos.



Floodplain Farming

Soil located in or near a channel of flowing water is usually moist and fertile. For this reason, floodplain fields were situated along the margins of permanent or ephemeral streams, the low terraces of arroyos, or within the bottoms of arroyos. The principle is similar to the moisture and fertility enhancement utilized by check dam agriculture located in steeper arroyos. In this case, flatter areas in drainages were planted, where a raised water table was also useful to the cultivator.

One disadvantage to such sites is cold air drainage into these canyon bottoms. The accumulation of cold air makes these sites susceptible to late spring and early fall frosts, limiting the length of the growing season. Other disadvantages limiting use of these areas are the danger of floods wiping out fields and the difficulty of clearing the thick riparian growth.

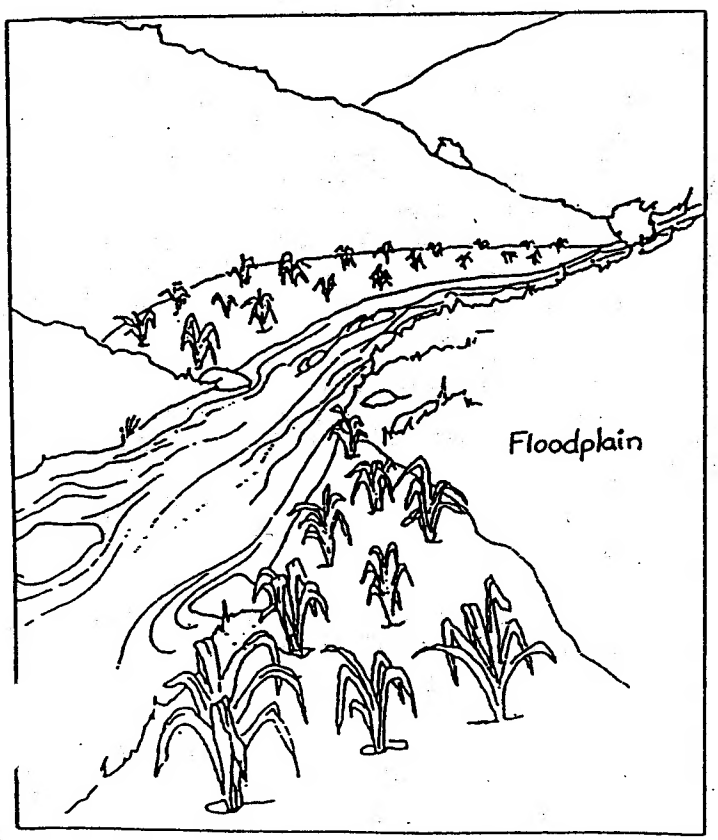
Often brush weirs or earthen walls were used to slow or spread water across the fields. This led to irrigation which spread the water over more land enabling more crops to be grown with more control.

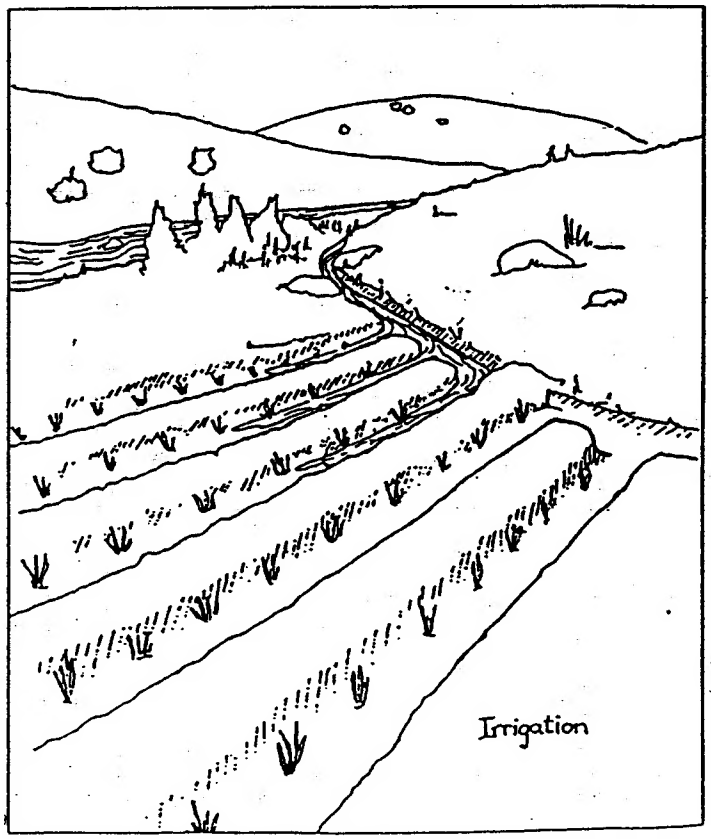
Irrigation

That there was irrigation before the arrival of the Spanish is clear. Its exact extent and character is not. What we do know is that it was not as universal a trait of Pueblo agriculture in the past as it is now, and was only one of a wide range of farming techniques used.

It is not clear to what extent the Rio Grande and other large rivers in northern New Mexico were used prehistorically for irrigation. Modern farming eliminates the evidence of previous irrigation systems and scholars do not agree on the documentary evidence. At Santa Clara Pueblo, the looser soils in the canyon and immediately surrounding the village, seem to have been preferred sites for irrigation. These areas were watered by Santa Clara Creek.

As late as 1940, almost all irrigated fields were located in the vicinity of Santa Clara Creek. There appears to have been only a gradual shift of landholding from the area around the pueblo to the river bottom, indicating that at Santa Clara, river bottom cultivation was one small part of Pueblo agriculture. Typically, fields were scattered across the landscape at different elevations and in different environments to prevent a disaster from destroying all of the crops.





The Hohokam of southern Arizona built substantial irrigation canals to divert water from large rivers, but the eventual failure of these projects contributed to the destruction of their "advanced" civilization. In the Anasazi area, dry farming seems to have been the rule, and irrigation was small in scale compared to the Hohokam.

Following the Anasazi through time

The appearance of the various farming techniques through time gives us a view into the environmental effects of Anasazi agriculture and their responses to these effects. Originally simple swidden agriculture was practiced. Land was cleared, burnt and planted. As it was exhausted, new land was cleared. Eventually the original plot recovered and could be replanted. This extensive clearing increased erosion. Check dams and linear borders were being constructed late in the occupations of Chaco, the Mimbres area, the San Juan Basin, and other sites, such as Pot Creek Pueblo near Taos. These structures were apparently an attempt to halt the serious erosion caused by deforestation and clearing, the use of wild plants, and foot traffic. Despite these conservation attempts, these areas were ultimately abandoned. When a prolonged drought struck in A.D. 1276-1299, the food production systems were already under stress from the high population densities. The combination of the drought with the environmental degradation caused by heavy farming and residential use probably led to final abandonment of settlements.

Refugees from these areas built grid gardens, techniques intended to prevent the start of erosion. Rather than waiting for erosion to begin, farmers were now attempting to stop the process at its source before it began, an example of Anasazi farmers learning from past mistakes and adapting to their environments.

As noted above, at an earlier time, the Anasazi had rotated fields, farming one until it was exhausted, and then clearing another, and so on until they returned to the first many years later. However, as populations increased, the inhabitants were forced to use all available farmland in proximity to their villages. This forced the Anasazi to be somewhat nomadic, moving every 60 to 100 years when they had depleted a site's soil and other natural resources. After a period of time, the original group or another group could reinhabit an area, the soil fertility and natural resources having recovered from previous usage. This is a key part of pre-Columbian Pueblo land use patterns. Even after the adoption of corn, squash, and beans led them to a sedentary life-style in villages, they continued to be seminomadic at a much slower pace.

It was continuous habitation and the associated large scale populations, irrigation systems, building projects, deforestation, and soil depletion which contributed to the forced migrations of the 1300s. The land taught the Anasazi to keep things small and to move occasionally to allow it to rest. By remaining fluid within their environment, by using many techniques in various locations, microclimates, and elevations, and by maintaining an appropriately small scale, the Anasazi were able to survive where earlier growth and urbanization had failed. It is ironic that rather than learning from what has failed before and adopting what has succeeded, we have done the opposite. Like the Chacoans and Hohokam, we believe that our technical "advances", power, and grandeur make us exceptions to the constraints of our environment. And, just like them our failure will come to us as a surprise.

Editor's note. This article is an edited excerpt from a book to be published by Flowering Tree Permaculture Institute, called *The Corn is the Same as the People, A History of Santa Clara Pueblo Agriculture* by Joel Glanzberg.